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Defence nationale

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JAVELIN S-15 DRILL BOOK

(ENGLISH)

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FOREWORD

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2. This publication is effective on receipt.
3. Suggestions for amendments should be forward through normal channels to the Director Army Doctrine, Attention DAD 7, Fort Frontenac, PO Box 17000 Station Forces, Kingston, ON, K7K 7B4.
4. Unless otherwise noted, masculine pronouns apply to both men and women.
5. The NDID for the French version of this publication is B-GL-372-006/FP-002. The terminology used in this publication is consistent with the Army vocabulary.

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CHAPTER 1

THE JAVELIN MISSILE SYSTEM

GENERAL

1. The guided missile (msl) system, Javelin, is a man-portable shoulder launched weapon for defence against low-flying attacking targets. The msl is contained in a msl canister, which acts as the launcher when firing takes place. The aiming unit (AU) is shaped to fit onto the msl canister and together they provide the means of controlling the firing and guidance of the msl.
2. The system employs a beam-riding optical guidance system consisting of a stabilised tracking system and an auto-guidance system. In an engagement the operator, using the stabilised tracking system, tracks the target throughout with an aiming ring in his sight field of view. The AU guidance head houses a transmitter (TX) that is aligned with the aiming ring. During an engagement the TX emits two pulsed scanning beams which move in pitch and yaw planes forming a control region around the "in-flight" msl.
3. Two optical receiver pods on the msl tail monitor the position of the msl within the control region by detecting the pitch and yaw pulse bursts. This information is retransmitted via a short optical link along the msls longitudinal axis to the msl control electronics where the guidance demands are decoded. Corrective action is then taken by the msl control surface actuator to bring the msl to the centre of the control region and maintain it there until warhead detonation.
4. Facilities are included in the system to compensate for crosswinds and both low and high crossing rate targets.

ROLE

5. The role of Javelin is to provide air defence protection against very low-level air threats.

THE JAVELIN DETACHMENT

6. The detachment consists of four personnel:
 - a. the detachment commander;
 - b. the operator;
 - c. the driver/ communicator; and
 - d. the 2 I/C.
7. All personnel should be qualified Javelin Gunner. The established detachment is four personnel, but restrictions may reduce this to two personnel. In either case, two personnel will be deployed with the weapon when it is tactically sited on the battlefield.

JAVELIN DETACHMENT STORES

8. Depending on the type of operation, Javelin detachment stores will include one AU and up to six msls. This represents three days supply; the fourth day (to complete the basic load of 8 msls) is held by the Javelin Support Troop.

RESPONSIBILITIES

9. The detachment commander, **No. 1**, is responsible to the section commander for the efficient operation of his detachment. The detachment commander ensures the safety and protection of all personnel on the weapon site. He is also responsible for the maintenance of all equipment issued to his detachment. The operator, **No. 2**, performs his duties under the supervision of **No. 1**. The driver, **No. 3**, is responsible for the vehicle, and the communications equipment. He performs his duties under the supervision of **No. 1**. The 2 I/C, **No. 4**, performs his duties under the supervision of **No. 1**.

DUTIES

10. **No. 1** is in command of the detachment and will:

- a. ensure that all rules and SOPs are observed during the engagement of a target;
 - b. maintain his battle board, ensuring that the operator has all the necessary information;
 - c. ensure that all necessary reports are passed to the section commander or higher, as applicable;
 - d. ensure that communications are maintained with the control station of his net;
 - e. establish communications between the firing position and stand easy;
 - f. orders the proper fuze setting and crosswind;
 - g. relieve and assist the operator as necessary;
 - h. ensure that the detachment stores are accounted for, as per the checklist, and in working order at all times;
 - i. ensure that all equipment is correctly loaded and safely secured prior to moving the detachment vehicle;
 - j. supervise the maintenance and testing of the detachment equipment and report all malfunctions immediately; and
 - k. ensure that a system of relief is instituted to enable either himself or the 2I/C to be one of the two personnel at the weapon position.
11. **No. 2** works under the direction of **No. 1** and will:
- a. ensure that he is familiar with the Weapons Control Status, rules of engagement, SOPs and all restrictions relating to the weapon site being occupied;

- b. engage targets;
 - c. record battery usage; and
 - d. assist **No. 1** as necessary.
- 12. **No. 3** works under the direction of **No. 1** and will:
 - a. ensure that he is familiar with the Weapon Control Status, rules of engagement, SOPs and all restrictions relating to the weapon site being occupied;
 - b. ensure his vehicle and communications equipment is in working order at all times; and
 - c. assist **No. 1, No. 2 or No. 4** as necessary.
- 13. **No. 4** is second in command of the detachment, and will:
 - a. perform the same duties as the **No. 1**; and
 - b. assist **No. 1, No. 2 or No. 3** as necessary.

DESCRIPTION

- 14. The Javelin system consists of the following equipment:
 - a. **Main Assemblies:**
 - (1) guided msl, HE K106 A1 or K140 A1; and
 - (2) AU (AU).
 - b. **Ancillary Equipment:**
 - (1) First Line Test Set (FLTS) to provide a portable means for Pass/Fail testing of the AU, LML and the FLTS itself. The complete FLTS is contained in a

lightweight field handling container that also contains one spare lithium battery, two spare fuses, two spare collimator lamps, test adapter, Beta Light and a special screwdriver are also carried in this container. A shipping and storage container carries the FLTS within its field handling container.

- (2) Lightweight Multiple Launcher (LML) increases the engagement rate for the Guided Msl System Javelin and removes the effects of weight loss. The LML consists of two sections: the traverse head and the tripod. The LML provides a means of physically supporting and holding three canistered msls and an AU and provides the electrical connections necessary to initiate the firing and subsequent control of the msl from the AU.

c. **Training Equipment:**

- (1) Part task trainer (Javelin).
- (2) Drill canister provides an inert canister for drill and handling purposes. It has the same dimensions, weight and balance as an operational canister.
- (3) Training canister to provide a facility for AU training in a non-firing environment, and is transported in a field-handling container. It consists of an empty msl canister containing interface circuitry, which allows all the AU electronics to be powered up, with the exception of the TX unit in the guidance head.

CHARACTERISTICS

15. Msl characteristics are:

- a. **Propulsion**—two stage, solid propellant motor (Crake smokeless platinized cordite).
- b. **Warhead**—blast fragmentation with an impact/graze & proximity fuse.
- c. **Maximum speed**—Mach 1.4.
- d. **Power supply**—27.5 to 35.5 volts (nominal 30 V) DC, provided by thermal battery in msl.
- e. **Dimensions:**

(1) Msl:

- (a) length = 1345 mm;
- (b) body diameter = 76 mm;
- (c) wing span = 275 mm; and
- (d) weight = 12.7 kg.

(2) Msl in Canister:

- (a) length = 1390 mm;
- (b) forward tube diameter = 197 mm;
- (c) rear tube diameter = 95 mm; and
- (d) weight = 15.2 kg

(3) Msl canister in field handling container (FHC):

- (a) length = 1454 mm;

The Javelin Missile System

- (b) forward tube diameter = 233 mm;
 - (c) rear tube diameter = 135 mm; and
 - (d) weight = 18.7 kg.
- (4) FHC in full standard pack (FSP):
- (a) length = 1580 mm;
 - (b) height = 353 mm;
 - (c) width = 330 mm; and
 - (d) weight = 43.5 kg.

16. **AU Characteristics:**

- a. **Power Supply.** A 31 volts DC is provided by a disposable, long-life lithium battery mounted externally on the rear of the control unit.
- b. **TX.** A laser generated, pulsed beam pattern.
- c. **Optics:**
 - (1) monocular, field of view (FOV)—180 mils; and
 - (2) magnification—6 times.
- d. **TX Beam Dispersion:**
 - (1) wide—142 mils; and
 - (2) narrow—4.7 mils.
- e. **Dimensions:**
 - (1) AU—408 mm x 342 mm x 203 mm;

- (2) FHC—482.6 mm x 431.8 mm x 271.8 mm;
and
- (3) FSP)—573 mm x 482.6 mm x 339 mm.

f. **Weight:**

- (1) AU—8.5 kg;
- (2) AU in FHC—9.7 kg; and
- (3) FHC in FSP—20.5 kg.

17. **LML Characteristics:**

a. Operational weights:

- (1) traverse head—15.6 kg;
- (2) FHC—18.2 kg;
- (3) tripod stand—14.7 kg; and
- (4) FHC—16.0 kg.

b. Deployment limits:

- (1) levelling adjustments to compensate for
slopes up to plus 10 degrees or minus 10
degrees—176 mils;
- (2) height adjustments to compensate for
operator size:
 - (a) minimum height—1.6 m; and
 - (b) maximum height—1.9 m.

GUIDANCE

18. Guidance is semi-automatic command to line of sight (SACLOS), by means of a line of sight beam rider (LOSBR) with an initial gathering phase.

COVERAGE

19. Javelin provides the following coverage:

- a. **Bearing**—6400 mils.
- b. **Elevation** (maximum firing):
 - (1) shoulder launcher (SL)—176 mils to +800 mils; and
 - (2) LML—176 mils to +500 mils.
- c. **Maximum Standard Intercept Range:**
 - (1) 4.5 km—highly manoeuvring targets; and
 - (2) 5.5 km—stationary or direct approaching targets.
- d. **Minimum Intercept Range**—350 m.

CLIMATIC OPERATING RANGES

20. The system can be operated under the following conditions:

- a. **Temperature**—from -30° to $+60^{\circ}\text{C}$.
- b. **Pressure**—altitudes up to 1500 m above sea level.
- c. **Wind**—in crosswinds up to 25 knots (46 km/h).
- d. **Humidity**—up to $+40^{\circ}\text{C}$ at 95%.

- e. **Javelin Part Task Trainer**—from -20°C to $+52^{\circ}\text{C}$.

DROP LIMITS

21. The maximum drop height the canister/ msl can withstand without sustaining internal damage is as follows:

- a. unpacked canister—25 cm; and
- b. canister in FHC or FSP—75 cm.

NOTE

If the aiming unit is dropped it must be tested using the FLTS.

AIR PORTABILITY

22. The equipment can be lifted by helicopter and transported by unpressurized aircraft up to 10,000 feet above sea level.

SAFETY PRECAUTIONS

23. The Pressure Equilization Valve (PEV) must be operated for 7 sec before the canister is removed from the FHC.

24. The operator must never look at the sun through the monocular sight. The detachment commander must take this into account when carrying out an engagement and must be prepared to cease the engagement if necessary.

25. When operating, the system presents a laser hazard (Nominal Optical Hazard Distance - NOHD) out to 2 m in front of the AU for the naked eye and out to 16 m (Enhanced NOHD - ENOHD) if looking through 8 X binoculars.

26. The Javelin laser is classified 3B.

SAFETY ASPECTS OF THE WEAPON SITE

27. The launch site should provide maximum coverage through at least 2100 mls while conforming to the safety aspects of the weapon. Specifically, a radius of 10 m around the firing platform will be clear of any obstruction that might likely deflect the efflux of the first stage motor. Vehicles, stores, ammunition not immediately required will be positioned at least 90 m away from the firing platform in a position designated by **No. 1** or between 40 to 90 m if suitably protected. The trench is to be so designed that the expansion cone remains at least 0.5 m above ground level when in the firing position at a maximum angle of 800 mls. Any personnel wishing entry within the boundaries of the weapon site must be granted permission by **No. 1**.

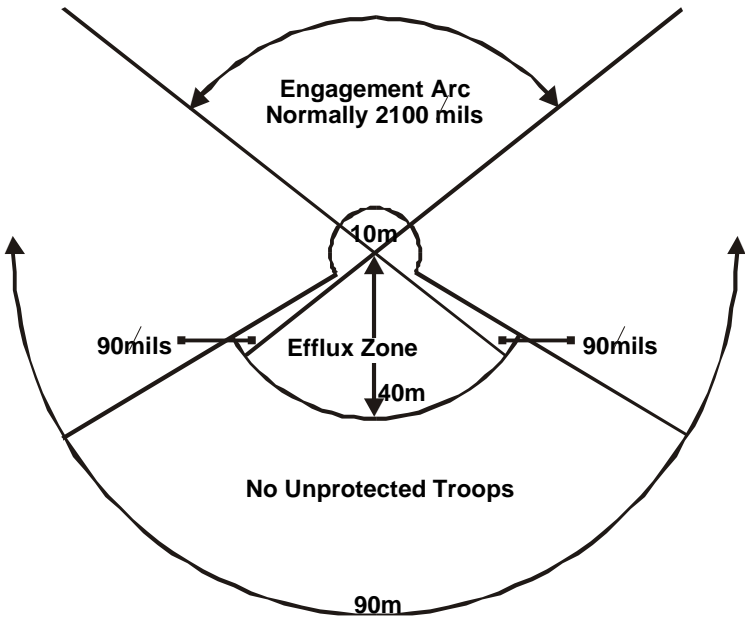


Figure 1-1: The Efflux Zone

28. The **No. 1** will designate a safe area at least 30 m to the left/right front of the firing platform where any misfired msls will be placed while awaiting for disposal.

29. Firing Sequence Javelin S-15:

SEQUENCE/ time (sec)	AIMING UNIT	MISSILE
System On	Rate sensor unit on guidance head activated Rate aided mode activated Aiming/Ranging (A/R) ring appears 25 sec timer starts (tracking phase) Wind offset applied (zoom narrow angle)	
Superelevation On	Superelevation applied (pitch fully stabilised)	
0.00 Trigger Pressed	25 sec timer disabled Guidance Head (GH) fully stabilised mode activated lead angle removed Crosswind removed A/R rings centre (zoom wide area)	Msl thermal battery fired gyro fired
0.30 Power of the msl battery rises	Control Logic Firing Sequence unit (CLFSU) starts Fuse mode 1 demanded	Pod battery fired proximity mode disable
0.55 1st Stage	TX on, 25 sec timer enabled	1st stage motor igniter activated

SEQUENCE/ time (sec)	AIMING UNIT	MISSILE
Motor Ignition	(engagement phase) Wind offset reapplied Gravity compensation starts	
0.58 Msl Launched		Bore Riding Pin (BRP) released, Photodiode Deployment Mechanism released, Ignition,Safety and Arming Unit (ISAU) starts
0.85 2nd Stage Ignition	Joy Stick (J/S) enabled, feed-forward starts (if no superelevation applied)	
1.35	Start superelevation decay	
1.73 2nd Stage Ends		
1.95	Ranging ring off	Fully armed
2.15	Superelevation decay ends J/S enabled Feed-forward ends	
4.55	J/S ramp starts	
13.5	Zoom ends	

SEQUENCE/ time (sec)	AIMING UNIT	MISSILE
17.55	J/S ramp ends	
25.55	25 sec timer stops	Self Destruct (SD) sequence initiated

CHAPTER 2

DEPLOYMENT AND ENGAGEMENT DRILLS

RV DRILLS

1. RV drills are as follows:
 - a. approach RV from the opposite direction of threat;
 - b. maintain dispersion as packet slows down;
 - c. get off road as soon as possible and maintain track plan;
 - d. all vehicles are backed into their appropriate spots;
 - e. detachment vehicles should be spread out 50 m apart;
 - f. camouflage all vehicles, set-up local defences and receive orders.

DUTIES AT THE RV—SECTION COMMANDER

2. Section commander will lead the section into the RV and assign them a parking area. He will then deploy air, ground, and NBC sentries and ensure vehicles are camouflaged. He will co-ordinate the local defence and ensures that the detachments know their crash drills and where to go. After the detachments have departed he will report the state of the section to the Troop commander (ammo, casualty, etc.) as well as get briefed on any liaison to be performed.

DETACHMENT COMMANDER AT THE RV

3. The detachment commander is responsible to ensure that the track plan is maintained, and that dispersion, camouflage and noise policies are adhered to. He must also ensure that the detachment knows the password, where the command post is, and the direction of the threat. He will then report for orders.

WEAPON SITE DATA CARD

4. The Weapon Site Data Card contains all the information required to enable the detachment commander to carry out the occupation of his Javelin site. The section commander will complete as many serials of the site data card as possible in the time available for reconnaissance. A sketch of the Javelin site will be drawn on the reverse side of the Weapon Site Data Card if required to assist the detachment commander in carrying out his deployment. It should only be used when:

- a. the position is difficult to occupy;
- b. the position is to be occupied at night; and
- c. time permits.

INTO ACTION DRILLS

5. The detachment vehicle should be driven as close to the position as possible, but not so close as to jeopardise the tactical value of the position (100 m is the rule of the thumb).

ACTION

6. Upon arrival at the desired location, **No. 1** will order “**HALT, ACTION**”.

- a. **No. 1** will carry one msl in its FHC and the necessary stores to a suitable interim position.
- b. **No. 2** will carry one msl in its FHC, the AU in its FHC, and a lithium battery to the interim position.
- c. **No. 3** will assist in the off loading of equipment, remove the vehicle from the weapon site, camouflage the vehicle in the location indicated by **No. 1** and will bring the remaining equipment required by the detachment.

- d. Upon arrival at the interim position **No. 1** orders “**LOAD**” and assisted by **No. 2** carries out the load drill.
- e. **No. 1** designates interim arcs to **No. 2**.
- f. **No. 1** reports “**READY**” to higher.
- g. **No. 1** physically recces 100 m around his position for the, misfire pit, rest area, and alternate position, and for the best Javelin position available unless he has been ordered otherwise by the section or troop commander.
- h. **No. 1** adopts the best position (or the position as ordered) and briefs the **No. 2**, **No. 3** and **No. 4** on the arcs and tactical situation.
- i. **No. 1** establishes the work routine.
- j. **No. 1** prepares the battle board.

NOTE

When mating or unmating the aiming unit personnel must avoid using the control handle assembly to prevent damage.

LOAD

- 7. **No. 1** orders “**LOAD**”.
- 8. **No. 2** unpacks the AU from its FHC, removes the optics protective cover and checks that:
 - a. the trigger is in the safe position;
 - b. the SYSTEM switch is set to OFF;

- c. the monocular and TX optics are clean and undamaged;
 - d. the interface connector is clean and serviceable;
 - e. the humidity indicator is blue;
 - f. ensures the fuze switch is positioned to 2, unless otherwise ordered; and
 - g. the battery is correctly fitted in the AU.
9. **No. 1** opens a msl FHC and operates the PEV on the msl canister for seven seconds.
10. **No. 1** checks that:
- a. the front cover is undamaged and correctly fitted to the msl canister;
 - b. the msl canister forward tube is not fractured or delaminated;
 - c. the hand locator is securely attached (see note);
 - d. the forward tube is securely attached to the diaphragm, in that the manacle clamp is secured and is located within 3 cm of the thermal battery housing;
 - e. the diaphragm is not fractured;
 - f. the humidity indicator is blue;
 - g. the interface connector is clean and undamaged;
 - h. the rear tube is not dented or cracked and there are no flaws in the metal;
 - i. the expansion cone is not damaged in such a way that it will obstruct the blow-out panel; and
 - j. the blow out panel is undamaged and secure.

NOTE

1. If any fault is found during the checks (except item c), that round must not be fired until it has been examined and cleared by an Ammunition Technician.
2. If the hand locator is not secure, exceptional care must be taken during firing that the operator adopts the correct position with his left hand.

11. **No. 1** supports the msl canister in a vertical position, the front cover resting on a firm flat surface.

12. **No. 2** fits the AU to the diaphragm ensuring that the AU retaining catch is locked.

13. **No. 1:**

- a. opens the FHC of the second msl and carries out the checks;
- b. replaces the socket protective cap; and
- c. replaces the second msl in its FHC and places it in a safe position near the operator.

14. **No. 2** takes post.

UNLOAD

15. **No. 1** orders “UNLOAD” and prepares the next msl.

16. **No. 2** ensures the SYSTEM switch is OFF.

17. **No. 2** assisted by **No. 1**, supports the msl canister in a vertical position, front cover resting on a firm, flat surface.
18. **No. 2** removes the AU from the diaphragm.

RELOAD

19. **No. 1** orders, "**RELOAD**".
20. Reload sequence:
 - a. **No. 2** ensures that:
 - (1) the trigger is at SAFE;
 - (2) the SYSTEM switch is set to OFF;
 - b. **No. 1** operates the msl canister PEV for seven seconds if required, removes the socket protective cap and supports the msl canister in a vertical position, front cover resting on a firm, flat surface.
 - c. **No. 2** fits the AU to the diaphragm ensuring that the AU retaining catch is locked.

LIGHTWEIGHT MULTIPLE LAUNCHER DRILLS

21. The deployment of the LML is an upgrade to an existing firing position and will be used if the expected or actual time on task exceeds 2 hours. The LML will be deployed on order, after the detachment commander has confirmed the permanent firing position.
22. After camouflaging the detachment vehicle, **No.3** carries the tripod, traverse head and a msl to the position and observes the arcs while **No. 1** and **No. 2** perform their drills.
23. **No. 1** and **No. 2** carry out the following drill:
 - a. **No. 1** and **No. 2** remove the tripod from its FHC and support it on its base plate.

b. **No. 1:**

- (1) centres the three adjustment studs (approx. 1 cm of thread showing at the head); and
- (2) holds the support tripod in a vertical position.

c. **No. 2:**

- (1) unfolds all three legs and engages the leg latches;
- (2) unclamps the support collar by turning it anti-clockwise until it reaches the stop;
- (3) firmly slides the support collar to the bottom of the support tube and releases the leg retaining latches;
- (4) clamps the support collar by turning it clockwise;
- (5) levels the tripod using the hand adjustment studs; and
- (6) pickets the foot pads and base plate to the ground.

24. **No. 1:**

- a. removes the traverse head from its FHC and ensures that the support tube pintle and the traverse head inner sleeve are free from obstructions and dirt;
- b. mounts the traverse head on to the support tube pintle;
- c. unclamps the sight arm from its stowed position and swings the arm downward into the horizontal position; pushes the sight arm fully forward until

the pin in the sight arm support tube engages the notch of the sight arm casting; and

- d. ensures that the sight arm clamping screw is locked tightly prior to mating the AU with the sight arm assembly.

25. **No. 1** prepares the required three msls and orders “**LOAD**”.

LOAD

26. **No. 1** orders “**LOAD**” and removes the three msl interface connector covers on the traverse head, and checks to ensure that the connectors are clean and serviceable.

27. **No. 2** holds the traverse head stationary, ensuring elevation lock is engaged.

28. **No. 1** and **No. 2** load three msl canisters as follows (see notes):

- a. **No. 1** holding the msl canister with the left hand halfway along its length and the right hand under the forward tube, places the rear tube into the loading chute, ensuring that the alignment of the diaphragm and the chute is correct.
- b. **No. 2** steadies the LML with his left hand and supports the rear tube, while **No. 1** pushes the msl canister fully home until the spring retaining clip engages with a "click".
- c. **No. 1** checks the humidity indicator for correct location. If any red shows the msl canister is removed and replaced by another.
- d. **No.3** holds the sight arm stationary.
- e. **No. 2** removes the protective cap from the interface connector and checks to ensure that the connector is clean and serviceable.

- f. **No. 1** and **No. 2** unmate the AU from the diaphragm of the loaded msl.
- g. **No. 2:**
 - (1) fits the AU to the sight arm diaphragm;
 - (2) ensures the AU retaining catch is locked; and
 - (3) selects the first msl.
- h. **No. 1** places the original msl canister in a FHC.
- i. **No. 1** checks the level of the LML and if necessary, orders **No. 2** to re-level using the hand adjustment studs.
- j. **No. 2:**
 - (1) adjusts the height of the AU eyepiece using the height adjustment sleeve on the support tube;
 - (2) releases the elevation lock; and
 - (3) observes the primary arc.

NOTE

1. Msl canisters are to be loaded in the following sequence: top outer, top inner, bottom inner.
2. A single missile may be loaded into any chute; however, the missile selector switch must be set to the corresponding position.

WARNING

When loading the second missile, care must be taken that the expansion cone does not damage the front cover of the first missile.

TO UNLOAD

29. **No. 1** orders “UNLOAD”.
30. **No. 1** places the msl FHCs close to the LML.
31. **No. 2:**
 - a. ensures that the SYSTEM switch is at OFF;
 - b. engages the elevation lock; and
 - c. releases the msl canister retaining catch of each msl in turn in the order bottom inner, top inner and top outer.
32. **No. 1** unloads the msl canisters, replaces their interface connector protective caps and secures them in the FHCs.
33. **No. 2** replaces the interface protective plugs of the traverse head.

RELOAD

34. **No. 1** orders “**RELOAD**” and prepares the required msls.
35. **No. 2:**
 - a. sets the **SYSTEM** switch to **OFF**;
 - b. engages the elevation lock;
 - c. assists **No. 1** with the loading of the msl(s);
 - d. **No. 1** removes the fired canister and places it to one side;
 - e. **No. 1** loads one msl canister;
 - f. **No. 2** selects msl **no. 1**;
 - g. **No. 1**, if necessary, orders, “**RELOAD TWO/THREE**”;
 - h. **No. 1** and **No. 2** carry out the reload drill on each msl canister in turn;
 - i. **No. 2** releases the elevation lock; and
 - j. **No. 1** and **No. 2** continue normal observation.

MISFIRE DRILLS

WARNING

In peacetime this drill is modified as per Chapter 9, Section 3 of B-GL-304-003/TS-OA1.

FIRST STAGE MISFIRE DRILLS

36. If after pressing the trigger the msl fails to launch, the immediate action is for the **No. 2** to fully release the trigger and safety catch, disengage the safety catch and press the trigger a second time. If the msl launches, the operator continues the engagement.

37. In SL mode if the msl again fails to launch within three seconds, **No. 2** reports, “**MISFIRE**” and:

- a. **No. 2** keeps the weapon on the shoulder, trigger engaged with the system pointed within safe arcs, for ONE MINUTE.
- b. After one minute has elapsed, **No. 1** orders “**MISFIRE, UNLOAD**”.
- c. **No. 2** releases the trigger and ensures that the safety catch is at Safe and sets the SYSTEM switch to OFF.
- d. **No. 2** keeping system parallel to the ground lowers the weapon and gives it to **No. 1**, who holds it with one hand on each side of the AU. **No. 1** and **No. 2** rotate the AU upside down maintaining a safe point of aim.
- e. **No. 2** removes the AU from the diaphragm, and adopts a crouching position until **No. 1** is clear of the site.
- f. **No. 1** places the msl canister in a safe area/misfire pit, ensuring that the msl canister remains pointing in a safe direction.
- g. **No. 1** orders, “**LOAD**”. **No. 1** and **No. 2** carry out the necessary load drill.

38. In the LML mode if the msl fails to launch within three seconds, **No. 2** reports, “**MISFIRE NUMBER ONE**” (two or three) and:

a. **No. 2:**

- (1) fully releases the trigger and safety catch;
- (2) sets the SYSTEM switch to OFF;
- (3) using the msl selector switch, selects the next msl for firing;
- (4) sets the SYSTEM switch to ON;
- (5) re-engages the target;
- (6) if a msl launches, continues with the engagement. On completion of the engagement carries out the misfire drill;
- (7) if the msl fails to launch, reports “**MISFIRE NUMBER 2**”(three); and
- (8) keeps the system pointed within safe arcs for one minute timed from the last reported misfire.

WARNING

If the second and third missiles misfire, the third must be unloaded first.

- b. After one minute has elapsed from last misfire, **No. 1** orders, “**MISFIRE, UNLOAD**”.

c. **No. 2:**

- (1) releases the trigger and safety catch;
- (2) sets the SYSTEM switch to OFF;
- (3) engages the elevation lock;

- (4) holds the traverse head while **No. 1** moves to the front of the LML, being careful not to allow any part of his body to pass behind or in front of the msl canisters; and
 - (5) holds the traverse head stationary and operates the msl canister retaining catch.
- d. **No. 1:**
 - (1) removes the misfired canister clear of the LML, ensuring that the expansion cone does not point at the remaining msl canisters and removes the misfired canister to a safe area;
 - (2) if more than one misfire has occurred, the drill is repeated; and
 - (3) orders “**LOAD**”. **No. 1** and **No. 2** carry out the necessary load drill (see Notes).

NOTE

- 1. If more than one missile has misfired, full aiming unit tests are to be carried out before the reload is ordered.
- 2. Misfires are disposed of IAW SOPs (see also Chapter 3).

SECOND STAGE MISFIRE DRILLS

WARNING

In peacetime this drill is modified as per Chapter 9, Section 3 of B-GL-304-003/TS-OA1.

39. When a msl is launched but the second stage motor does not ignite the drill is as follows for both SL and LML:

- a. **No. 1** orders “**TAKE COVER**”; and
- b. **No. 1** assesses tactical scenario, and decides whether to continue in his present position or to move to the alternate.

40. The msl is electrically charged, and therefore armed, for 45 minutes. The detachment commander must take this, and the location of the misfired missile, into account when deciding whether or not to move to the alternate position.

DETACHMENT COMMANDER'S BATTLE BOARD OVERLAY

41. The battle board is designed to enable the detachment commander to record pertinent information from the Weapon Site Data Card and any identifiable reference objects. These will be used to brief his detachment and give search and engagement orders. The battle board overlay is printed on matte talc and is scaled to be used in conjunction with any map of 1:50,000 scale. It consists of an outer ring representing a radius of 7 km, scribed in 100 mils increments, and two inner circles with representative radii of 5 km and 3 km and a centre point which represents the firing position. The lower left and right corners of the overlay are devoted to an aide-memoire, which includes the following:

- a. LOCSTAT with:

- (1) grid of Javelin position; and
 - (2) primary and secondary arcs.
- b. Weapon control status (WCS).

42. Upon occupying his position the detachment commander will set up the overlay as follows:

- a. orient his map;
- b. locate and place the centre of the overlay over the Javelin position;
- c. complete the aide-memoire by filling out the loc state, and weapon control status;
- d. number the outer ring;
- e. mark on primary and secondary arcs (secondary arcs if not given by troop/section commander should be selected by detachment commander and adopted after confirmation with section/troop CP);
- f. identify and mark any prominent objects or features within the arcs; and
- g. mark any other pertinent information, such as:
 - (1) local defences;
 - (2) other air defence weapons or units;
 - (3) position of troop CP;
 - (4) positions of friendly troops;
 - (5) transit routes, air corridors, etc., which may be of assistance in completing the assigned task;
 - (6) air defence warning;

- (7) reference points and ranges; and
- (8) states of readiness.

43. Once the battle board overlay has been set up it must be amended as soon as new information becomes available. It must remain at the weapon site so it can be used for briefing members of the detachment on current data.

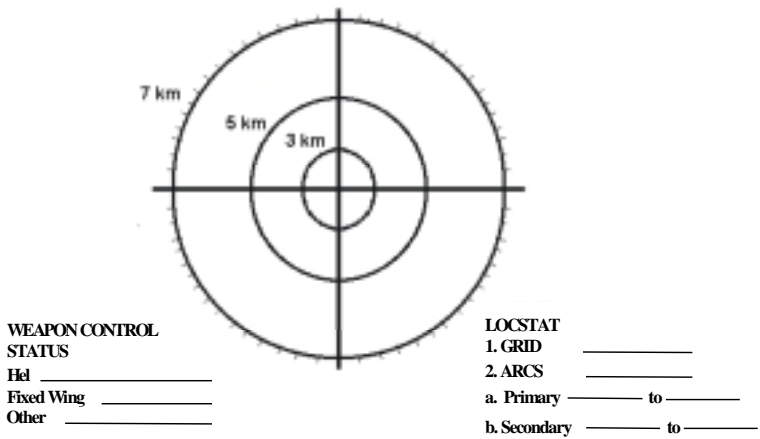


Figure 2-1: Battle Board Overlay

JAVELIN COVERAGE CALCULATOR

44. The Javelin coverage calculator is a template, which is used to calculate the area in which a Javelin msl will impact an aircraft under various conditions. The size of the impact area will indicate the area of effective coverage that is provided for a vital point (VP) that is being protected. When there is no VP (such as in an attritional or route defence) the weapon site will be deemed to be the VP for purposes of conducting a defence analysis. The coverage diagram that is produced by each detachment allows the troop/section commander to determine with a quick glance any areas or approach routes that require additional coverage by air defence systems.

45. Successful engagements are based on four criteria:
- a. target speed of 250 m/s;
 - b. operator reaction time of seven seconds (target at 250 m/s covers 1750 m in seven seconds);
 - c. maximum of 500 m from detachment to VP;
 - d. line of weapon release/1000 m, 1500 m or 2000 m; and
 - e. the calculator is based on two of these factors:
 - (1) target speed of 250 m/s; and
 - (2) reaction time of seven seconds.
46. Characteristics:
- a. The coverage calculator is transparent (for map work).
 - b. Impact/Envelope box is cut out 1 km right and left of centre axis.
 - c. The two parallel lines extending down 4 km are referred to as fly lines. They are used to indicate crossing targets to the Weapon Position (WP).
 - d. Twelve holes are cut out for:
 - (1) Weapons position.
 - (2) Line of weapon release (LWR)—1000 m, 1500 m, 2000 m. Type of target and the weapons likely to be used against it determine the LWR. The troop commander will order the LWR based on his threat assessment.

Deployment and Engagement Drills

- (3) Five detection ranges—3 km, 4.5 km, 6.5 km and 10 km (for fast moving targets), plus a 5 km detection range (for moving helicopters). The box that the template will produce shows where target and msl meet.
- (4) An impact box is used in conjunction with the fly lines to verify if engagements on the left and right arcs will present crossing targets.
- (5) Romer.

DRILLS FOR USE

47. On a piece of talc, produce a coverage trace in the following manner:

- a. Plot the VP if any.
- b. Plot the Javelin position.
- c. Insert pencil in hole marked WP and place it over the VP with a marker (red) in the appropriate LWR range, draw a circle around the VP.
- d. Determine arcs and plot them from the Javelin position.
- e. With the hole marked WP superimposed over the Javelin position, align the bottom left corner of the impact box with the left arc, if the VP falls outside the fly lines, that particular arc should change. Adjust the corner until the VP falls inside the fly lines, this should be your new left-of-arc. Repeat for the right arc.
- f. Divide into sectors as determined by the unmasked calculations (see para 48 below) and mark each sector.

- g. Superimpose the WP hole on the Javelin position, and with a marker in the hole corresponding to the detection range for each sector draw in the maximum impact range (repeat for each sector). Trace the outer edges of the envelope and erase all other details.

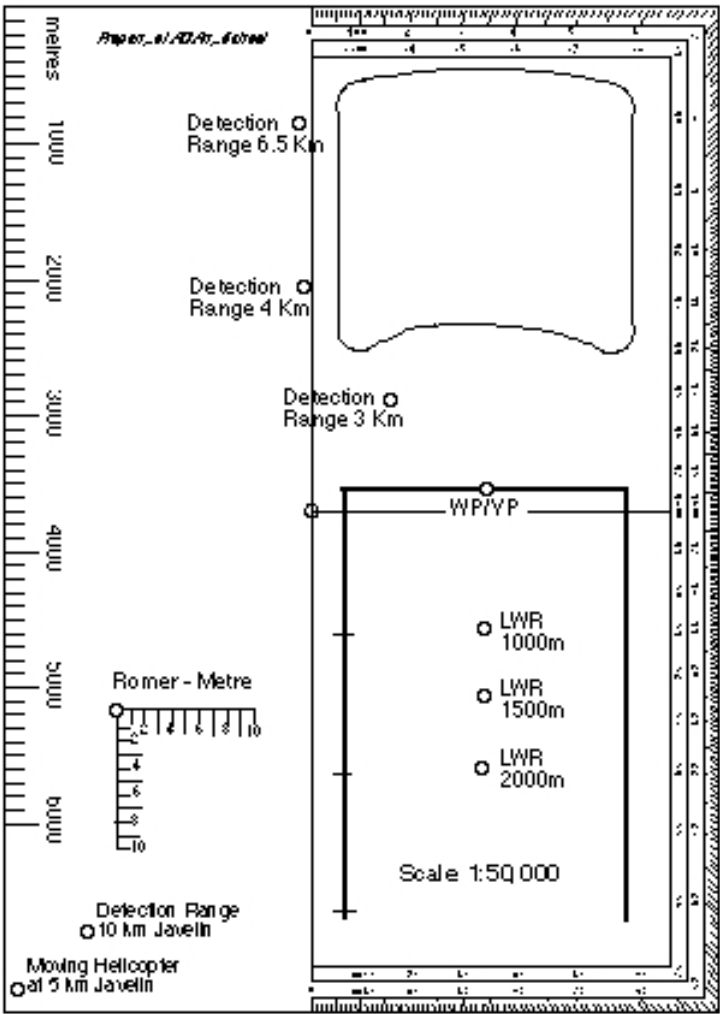


Figure 2-2: Coverage Calculator

WORM RULE (CALCULATION OF ANGLE OF SIGHT)

48. A Javelin position is limited in its line of sight by obstacles and wood line crests. The effectiveness of the system is reduced because the detachment cannot see a fast approaching target until it is too late. The detachment must be aware of the exact ranges a target will appear or unmask itself to the detachment, above the crest or obstacle. As soon as possible after occupying a Javelin position, in order that the section/troop commander can assess his section/troop coverage and ensure that all likely approaches of a target are covered, the detachment commander must:

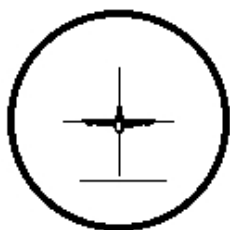
- a. determine arcs;
- b. identify any obstacles in the arcs;
- c. estimate the range from position to the obstacles or crests using the map;
- d. determine the angle of sight of the obstacle using the formula—angle of sight (in mils) = difference in height (m) of the position and the height of the crest ÷ range in km; and
- e. using an unmasked increment chart or graph, determine the range increment, add it to the range from the position to crest, and get the unmasked range for that obstacle.

LEAD ANGLE

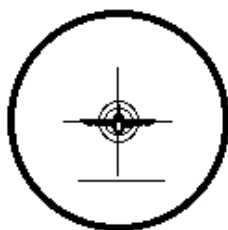
49. As the operator tracks the target, rate gyroscopes in the optical head detect the movements of the AU. The outputs of these gyroscopes are fed to the mirror servo system to automatically correct the position of the rings in the monocular field of view. When the msl is fired it will appear ahead of a crossing target (i.e. a lead angle is introduced to the tracking system before launch).

TO APPLY LEAD ANGLE

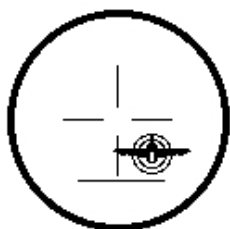
50. The operator acquires the target in the FOV and, when his aim is stable, turns the SYSTEM switch ON. The operator should attempt to track the target for at least 3 seconds to establish enough input to get a good lead angle.



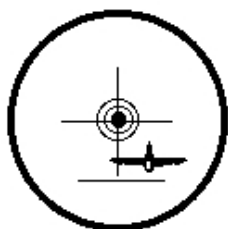
1. Target acquired



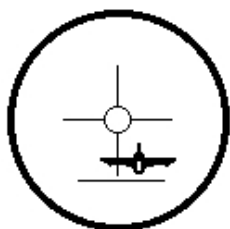
2. System switch ON



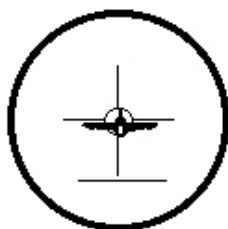
3. Lead angle applied



4. Trigger pressed,
rings move to crosswires
missile gathers



5. Range ring disappears



6. Normal tracking resumed

Figure 2-3: Lead Angle

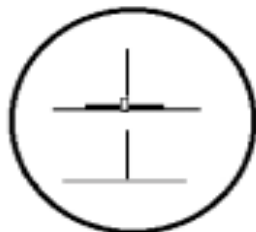
CROSSWIND CORRECTION

51. Crosswind correction is only necessary for winds in excess of 15 knots, blowing across the line of sight. It should be noted that large trees sway noticeably in a 15 knot wind. To determine wind direction a suitable, inconspicuous marker (such as a strip of hesian or sandbag tied to a branch) should be placed immediately in front of the firing position.

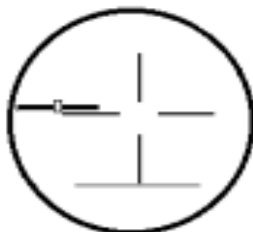
TO APPLY CROSSWIND CORRECTION

52. Having first determined that the wind speed is in excess of 15 knots and at or near to a right angle to the direction of fire, the operator carries out the following:

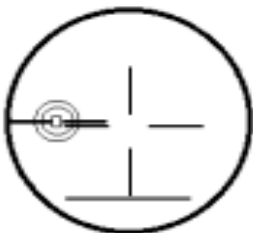
- a. Sets the CROSSWIND CORRECTION switch to either:
 - (1) the left position, if the wind is blowing from the left; or
 - (2) the right position, if the wind is blowing from the right.
- b. Acquires the target in the FOV by placing it at the extreme left or right (left correction = left side) of the horizontal aiming mark.
- c. Turn the SYSTEM switch ON.
- d. Continues with the engagement.
- e. Immediately after launch, smoothly re-lays the centre of the sight on the target and then continues to track the target, at the same time keeping the aiming ring accurately aligned with the target throughout the engagement, by means of the joystick.



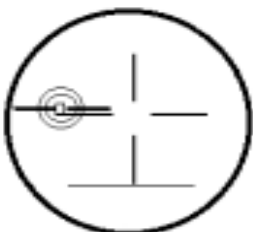
1. Track target with crosswires.



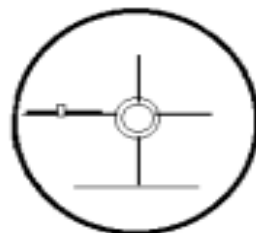
2. Appropriate Aim-off Mark on target



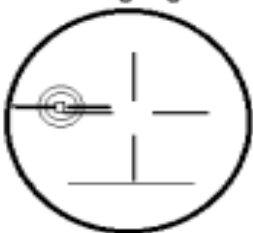
3. System ON Aiming Mark on target



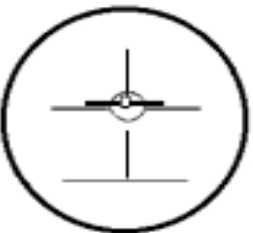
4. Track target with Aiming ring



5. Trigger pressed (Gyro fire)



6. Missile IOF Aiming and Range ring reappear on the target



7. Continue to track the target with the crosswires and maintain the Aiming ring accurately on the target using the joystick.

Figure 2-4: Crosswind Correction

SUPERELEVATION

53. Superelevation is a method of aim-off applied by the operator to ensure that when a msl is fired, it is launched clear of the ground, sea or any other obstruction.

54. Care must be taken to apply superelevation correctly. The operator must ensure that the aiming ring is not positioned below the target when superelevation is applied, otherwise ground impact may occur when engaging very low targets. This application will also delay the time at which joystick inputs can be applied to the msl (approx. 2 secs).

TO APPLY SUPERELEVATION

55. If, when engaging a target, the ground, sea or any other obstruction within 400 m of the firing position appears above the superelevation line in the field of view the operator applies superelevation as follows:

- a. carries out the target engagement drill as far as applicable;
- b. ensures that the aiming ring is positioned accurately on the target;
- c. presses and holds the SUPERELEVATION button;
- d. smoothly elevates the system until the top of the obstruction appears on the superelevation marker, at the same time continuing to track the target with the aiming ring;
- e. releases the SUPERELEVATION button; and
- f. disengages the safety catch and presses the trigger.

56. After launch the aiming ring will return to the centre of the cross wires until the msl is gathered, then drop back down into alignment with the target, whereupon the operator:

- a. keeps the aiming ring accurately aligned with the target by means of the joystick; and
- b. smoothly depresses the system until the cross wires are aligned with the target.



1. Track target with crosswires .



2. System switch ON, lay Aiming ring accurately over the target.



3. Press and hold Superelevation button and elevate until obstruction appears on Superelevation marker, keeping Aiming ring on target, release button.



4. After firing, Aiming ring returns to centre until missile is gathered.



5. After gathering, Aiming ring drops down on the target, operator takes control with the joystick.



6. Re-lay crosswires on to target and continue to keep Aiming ring accurately using joystick.

Figure 2-5: Superelevation Correction

**TO APPLY CROSSWIND CORRECTION AND
SUPERELEVATION**

57. To apply both crosswind correction and superelevation, the operator carries out the two drills inclusive. Immediately after launch, the operator:

- a. smoothly re-lays in azimuth until the vertical cross wire is in line with the target; and
- b. maintains the same elevation.

58. When the msl has gathered and the aiming ring has dropped down into alignment with the target, the operator:

- a. keeps the aiming ring accurately aligned with the target by means of the joystick; and
- b. smoothly depresses the system until the cross wires are aligned with the target.

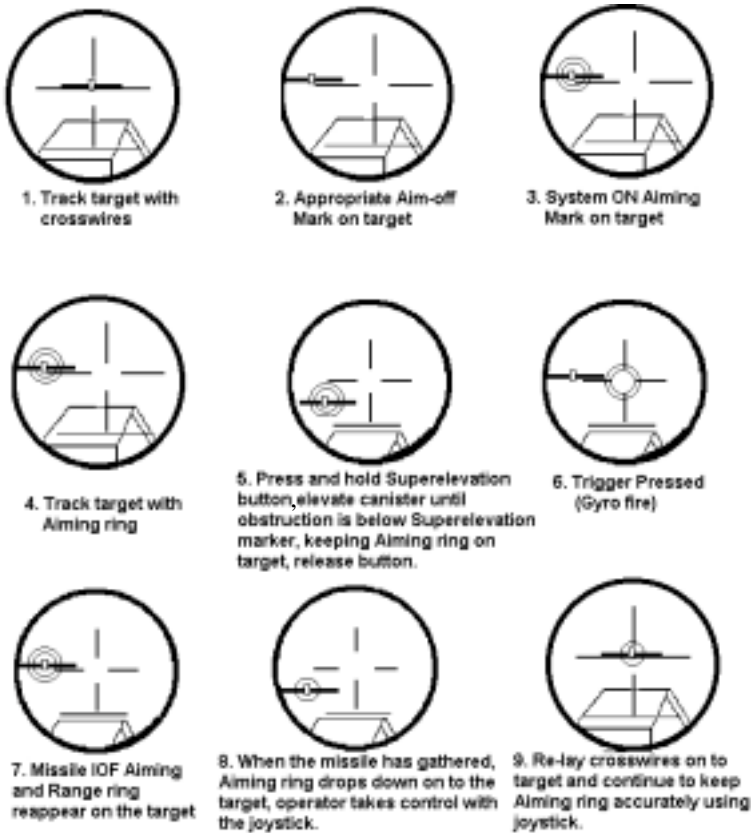


Figure 2-6: Crosswind and Superelevation

ACTION ON DRILLS

RECEIPT OF EARLY WARNING

59. On receiving an early warning:
- a. **No. 1** orders “**TAKE POST**”, uses the battle board to relate situation to the primary arc.
 - b. **No. 2** adopts the ready position with system on shoulder observing arcs.

- c. **No. 1** and **No. 2** observes in the direction of the OP warning. If a target is seen, the drill continues. After 2 minutes if no target is seen or heard, **No. 1** may order “**REST**”. **No. 1** and **No. 2** maintains a visual watch over the alerted sector in addition to the primary arc, for a further three minutes.

SIGHTING A TARGET

60. The first member of the detachment to see a target in the area will inform the other by reporting “**TARGET**” and indicating its location using the reference points for the Javelin position.

61. **No. 2** will locate the target and report “**SEEN**”, set the fuze and the CROSSWIND CORRECTION switch as ordered, shoulder the system or verify msl selector (LML) and identify as “**HOSTILE**”, “**FRIENDLY**” or “**NOT RECOGNIZED**”. Tracking will continue until the detachment commander orders “**REST**”. This will not normally be ordered unless the aircraft is identified as Friendly.

62. **No. 1** will ensure that a full report of the sighting is made to the next higher authority immediately.

ENGAGEMENT OF A TARGET

63. **No. 1** must confirm target is “**HOSTILE**”.

64. **No. 1** will assess situation and order “**ENGAGE**”.

65. **No. 2** will acquire and track the target. (If the target is not immediately acquired he will look over the sight to search the arc and then again attempt to acquire)

66. **No. 2** operates the firing trigger, or upon receipt of the order “**HOLD FIRE**” carries out the appropriate drills.

TERMINATION OF AN ENGAGEMENT

67. An engagement is terminated when:

- a. the target is recognised as friendly or friendly aircraft are endangered;
- b. the msl is seen to successfully intercept with the target;
- c. the msl is seen to self destruct; or
- d. ground impact is observed.

TERMINATING AN ENGAGEMENT

68. To terminate an engagement, the **No. 1** can order “**HOLD FIRE**” and the **No. 2** carries out the following drill:

- a. Prior to msl launch, **No. 2**
 - (1) sets the SYSTEM switch to OFF; and
 - (2) prepares to engage another target.
- b. After msl launch:
 - (1) **No. 2** steers the msl to a safe area and then sets the SYSTEM switch to OFF;
 - (2) **No. 1** and **No. 2** carry out the reload drill or **No. 2** selects the next msl (LML);
 - (3) **No. 2** prepares to engage another target.

RE-ENGAGING THE SAME TARGET

69. If the AU shuts down or, it is obvious to the **No. 1**, the msl has missed but the target is still in range, **No. 1** orders, “**RE-ENGAGE**”.

70. **No. 2:**

- a. sets the SYSTEM switch to OFF;

- b. reloads or selects the next msl (LML);
- c. sets the SYSTEM switch to ON; and
- d. re-acquires, tracks and engages the target.

ENGAGING A FRESH TARGET

71. When the msl is seen to hit, or the target is no longer in range, and a fresh target is available, **No. 1** orders, “**TARGET LEFT/RIGHT, ENGAGE**”.

72. **No. 2:**

- a. sets the SYSTEM switch to OFF;
- b. reloads or selects the next msl (LML);
- c. locates the new target and reports “**SEEN**”.

73. **No. 1** and **No. 2** identify the target as “**HOSTILE/FRIEND/NOT RECOGNIZED**” as applicable.

74. **No. 2** acquires, tracks and engages the new target.

PREPARE TO MOVE

75. On receipt of the order “**PREPARE TO MOVE**”, **No. 1** has all equipment (less the detachment vehicle which remains camouflaged), removed from the position except:

- a. two msls;
- b. AU with spare battery;
- c. radio and **No. 1** stores; and
- d. trench camouflage net.

76. Unless otherwise specified, the LML will be disassembled as follows:

- a. **No. 1** orders “**PREPARE TO MOVE, UNLOAD**”.
- b. **No. 3** maintains observation of the arcs.
- c. **No. 2:**
 - (1) ensures that the SYSTEM switch is at OFF;
 - (2) engages the elevation lock;
 - (3) releases the msl canister retaining catch of chute 3.
- d. **No. 1** unloads a msl canister from the LML.
- e. **No. 1** supports the msl canister in a vertical position, the front cover resting on a firm flat surface.
- f. **No. 3** holds the sight arm stationary.
- g. **No. 2** removes the AU from the sight arm.
- h. **No. 2** fits the AU to the msl ensuring that the AU retaining catch is locked and gives it to the No. 3 who returns to observing the arcs.
- i. **No. 1** and **No. 2** continue to carry out the unload drill on the LML.
- j. **No. 1** unclamps the sight arm from its operational position and clamps it in the stowed position.
- k. **No. 1** removes the traverse head from the tripod and secures it in its FHC.
- l. **No. 1:**
 - (1) removes the pickets from the foot pads and base plate; and

- (2) unclamps the support collar.
- m. **No. 2** raises the height adjustment sleeve of the support tube.
- n. **No. 1** and **No. 2**:
 - (1) raise the support collar to the top of the support tube and clamp it;
 - (2) close the three legs with their pads flat against the support tube;
 - (3) lower the height adjustment sleeve; and
 - (4) place the tripod into its FHC.
- o. **No. 1, No. 2** resume observing the arcs while filling the trench to stage 2.
- p. **No. 3** stows all unnecessary equipment in the vehicle.

CEASE FIRING

77. When the order “**CEASE FIRING**” is received from the section commander the site will be evacuated. On receipt of the order:

- a. **No. 1** will:
 - (1) order “**CEASE FIRING, UNLOAD**”;
 - (2) secure his battle board;
 - (3) assist **No. 2** in removing the AU from the msl canister;
 - (4) replace the protective cap on the interface connector and then secure the msl canister in its FHC;

- (5) if necessary, secure the back-up round in its FHC;
 - (6) deal with misfired msls as detailed in SOPs; and
 - (7) conduct a sweep of the firing platform for any items of personal or detachment stores left behind.
- b. **No. 2** will ensure that:
 - (1) trigger is at safe;
 - (2) that the SYSTEM switch is set to OFF;
 - (3) unlock the AU retaining catch and assisted by **No. 1**, remove the AU from the msl canister, replace the optics cover and secure the AU in its FHC; and
 - (4) assist in loading and securing the detachment equipment.
- c. **No. 3** will:
 - (1) if necessary, disconnect and reel in the remote comms; and
 - (2) remove the camouflage from vehicle.
- d. **No. 4** will supervise the loading of the detachment vehicle and check the security of the equipment before moving.
- e. The detachment will then proceed to the position of assembly (POA) or next task.

EMERGENCY ENGAGEMENT

78. The drill for an emergency engagement, e.g., air attack on a convoy, varies from the normal in that the weapon site will have to be

quickly chosen, safety aspects rapidly determined and a report of the action may have to be delayed until after the engagement.

79. The drills are as follows:

- a. the vehicles immediately stagger on the route with the lead vehicle going right, the second vehicle going left, and so forth;
- b. when the vehicle stops, the detachment commander carries the radio and one msl to the nearest possible site;
- c. the operator carries the AU to the site;
- d. the vehicle heads for the closest cover possible;
- e. the detachment rapidly prepares for action and engages targets; and
- f. the detachment commander sends full report as soon as possible.

TARGET ENGAGEMENT (ONE PERSON OPERATION)

80. On sighting a target, the operator:

- a. ensures that the SYSTEM switch is set to OFF;
- b. sets the FUZE MODE switch to the required position;
- c. sets the CROSSWIND CORRECTION switch to the required position;
- d. shoulders the weapon;
- e. acquires the target in the monocular sight and tracks it with the cross wires;
- f. identifies the target as HOSTILE;

- g. obeies SOPs and the weapon control status in force;
- h. sets the SYSTEM switch to ON;
- i. tracks the target with the aiming ring;
- j. if necessary applies superelevation;
- k. disengages the safety catch and operatethe trigger;
and
- l. carries on with normal engagement.

POSITION OF ASSEMBLY

81. POA is a lay up area for the section to reassemble prior to proceeding to the future RV/hide/position.
82. A POA should meet the following criteria:
- a. be centralised and oriented in the direction of future deployment; and
 - b. have sufficient space to accommodate the whole section, taking in account dispersion (approximately 25 m between vehicles).
83. The POA should be occupied for the least possible amount of time. The senior call sign or section commander will lead the assembled vehicles to the future RV or position.

EXECUTIVE ORDERS AND MISCELLANEOUS REPORTS

84. Orders that affect the firing of a msl and the readiness of the detachment, which may be issued over the communications equipment and/or by **No. 1** are:
- a. **HALT ACTION** is an order detailing the detachment to deploy to the interim position.

- b. **LOAD** is an order detailing the detachment to mate a msl canister with the AU or LML.
- c. **UNLOAD** is an order detailing the detachment to unmated the msl canister and the AU or remove the msls from the LML.
- d. **RELOAD** is an order detailing the operator to transfer the AU from one msl canister to another (SL). In the LML mode it indicates that msl chute number 1 is to be loaded with a fresh msl.
- e. **RELOAD 2 AND 3** is an order used to indicate that the LML chutes number two and three are to be loaded with fresh msls. This may be broken down to individual chutes depending on the tactical situation.
- f. **ENGAGE** is an order used to direct or authorise fire units to engage a designated target. “**ENGAGE**” cancels any previous order.
- g. **REST** is an order detailing the operator to rest in position on the firing platform, he will continue to observe the arcs. “**REST**” is cancelled by a new order.
- h. **TAKE POST** is an order detailing the operator to take up his position on the firing platform and observe the arc of responsibility in readiness to engage targets.
- i. **HOLD FIRE** is an order used to stop firing, either to protect friendly aircraft or in the interest of safety. When the order “**HOLD FIRE**” is received, the engagement sequence must be stopped, and if a msl has been fired, it must be steered in a safe direction and destroyed.
- j. **TARGET** is an order that a potential target has been sighted and that the operator is to shoulder the system and identify the target.

- k. **TAKE COVER** is an order detailing all personnel to go to ground, behind cover if possible, (this order typically would be given upon the occurrence of a second stage misfire).
- l. **MISFIRE, UNLOAD** is an order detailing the detachment to perform the misfire unload drills.
- m. **PREPARE TO MOVE** is an order detailing the detachment to make preparations for an imminent move.
- n. **CEASE FIRING** is an order detailing the evacuation of the current weapon site.

85. Reports that affect the firing of a msl and the readiness of the detachment, which may be issued over the communications equipment and/or by detachment, are:

- a. **READY** is a report that the unit is operational.
- b. **SEEN** is a report that the indicated target has been seen.
- c. **NOT SEEN** is a report that the indicated target has not been seen.
- d. **HOSTILE** is a report indicating that a potential target has been positively identified as hostile according to hostile act criteria.
- e. **FRIENDLY** is a report that indicates the potential target has been identified as friendly according to friendly act criteria.
- f. **NOT RECOGNIZED** a report indicating that the target type is unknown.
- g. **TARGET LOST** is a report indicating that the target that had been acquired in the monocular field of view and was being tracked/engaged has been lost.

- h. **MISFIRE** a report that indicates all appropriate actions have been performed, the msl has not functioned correctly and that the misfire drill must be carried out.

TARGET SELECTION

86. Rules:

- a. a target or group of targets entering the primary arc is more important than a larger group outside the primary arc;
- b. a target or group of targets in the primary arc approaching the defended asset is more important than one in the primary arc that is crossing or receding; and
- c. the only time when switching targets before completion of an engagement is justified is in cases of self defence, or to switch to an approaching target within the primary arc while engaging a crossing or receding target outside the primary arc.

87. Priority:

- a. targets within the primary arc flying towards the weapon;
- b. targets outside the primary arc flying towards the weapon with priority given to the one closest to the primary arc;
- c. targets within the primary arc flying away from the weapon; and
- d. other targets.

DISTRIBUTION OF FIRE

88. Due to the short time available to distribute fire evenly over all of the attackers, **SOPs** must detail the distribution of fire in order to achieve fire on as many targets as possible. Examples of priorities are:

- a. For target attacking line astern:
 - (1) in the primary arc—engage the leading target;
 - (2) left of the primary arc—engage the second target; and
 - (3) right of the primary arc—engage the third target, or the lead target if only a pair is attacking.
- b. For target attacking line abreast:
 - (1) engage the target nearest to the centre of the primary arc; and
 - (2) if a second engagement is possible during the same attack, engage the target that offers the best chance of success under the circumstances.

CHAPTER 3

DISABLEMENT OF EQUIPMENT

GENERAL

1. The extent to which disablement should be carried out depends on the time available and the probability of recapture. In destroying equipment, all detachments must, as far as possible, follow the same procedure, so that if several pieces of equipment are captured they will all be deficient in the same essential parts.

TEMPORARY DISABLEMENT

2. To disable the Javelin system so that it can be brought into action immediately after recapture, remove the AU. The msl canisters should remain undamaged

DESTRUCTION

3. **Authorisation.** The authority for ordering the destruction of equipment is vested in divisional and higher commanders, who may delegate it to subordinate commanders when necessary.

4. **Reporting.** Reporting of the destruction of equipment is to be done through command channels.

5. **Priority.** Priority must always be given to the destruction of classified equipment and associated documents. When lack of time or means prevents complete destruction of equipment, priority should be given to the destruction of essential parts, and the same parts are to be destroyed on all similar equipment.

PRIORITY FOR DESTROYING JAVELIN

6. **Aiming Unit.** Smash the optics of the AU causing as much damage as possible and destroy the control handle assembly.

7. **First Line Test Set.** Destruction for this equipment is as follows:

- a. smash the collimator, cable connectors and control panel of the test set; and
- b. smash the body of the test set causing as much damage as possible.

8. **Missiles.** Destruction of msls will be carried out as follows:

- a. If time permits, the msls should be fired prior to the destruction of the AU. Msls should be fired in rapid succession, setting the SYSTEM switch to OFF immediately after launch. This will initiate the self-destruct process.
- b. If time does not permit the firing of the msls, they should be stacked and destroyed using explosive charges.
- c. If time or means prevents destruction of the msls as stated in sub para a and b above smash the interface connector on the msl canister.

9. Records, operating instructions, etc., which are subject to security regulations must also be destroyed. If time permits, stack all items of damaged equipment (not msls), pour fuel over the equipment, and ignite.

WARNING

The collimator gas is hazardous; the lithium batteries are toxic.

DISPOSAL OF UNSERVICEABLE MISSILES

10. A msl is to be considered unserviceable if:

- a. there has been a first stage misfire;

- b. there has been a second stage misfire; or
- c. it is physically damaged.

11. MsIs are to be disposed of as follows:

- a. MsIs (subparagraph 10c above) are to be back loaded under unit arrangements; and
- b. Misfired msIs (subparagraphs 10a and 10b above) after the misfire drill has been carried out, if appropriate, the msl is to be removed to a safe area and destroyed by explosives. The procedure to be adopted is given in paragraphs 12, 13 and 14.

DEMOLITION OF MISSILES

12. Stores required:

	ITEM	QUANTITY
a.	Charge demolition plastic explosive (PE)	0.75 kg
b.	Cord detonating L1	6 m or as required
c.	Detonator L1	1
d.	Safety fuze L1	8 m reel
e.	Matches fuze	As required
f.	Tape, adhesive, waterproof	As required
g.	Crimpers tool	1 pair

13. **Preparation.** The following preparation must take place prior to the demolition of msIs:

- a. Place the required amounts of PE in the positions shown on figures 3-1.

- b. Run equal lengths of cord detonating from the charges and join so that 100 mm of each cord detonating is in contact with the other and there is a 300 mm overhang. Knot the charge ends.
- c. Securely embed the knotted ends of cord detonating in the PE and tape it into position.
- d. Cut off and discard the first 300 mm of the safety fuze L1. Cut off the next 300 mm, ignite one end and note the time taken to burn through to the other end. If the burning time is between 35 and 43 seconds inclusive, the fuze remaining on the coil may be used otherwise the complete coil is to be rejected.
- e. Establish the time taken to walk to cover (at least 200 m away). Double this figure then measure and cut off the required length of safety fuze, minimum 600 mm, cutting the end for insertion into the detonator straight across and the other obliquely (scarfed).
- f. Inspect the detonator to ensure there is no obstruction in the cavity. If gently shaking the detonator does not remove any obstruction the detonator is to be set aside for destruction. On no account is any probe to be used in the open end of the detonator.
- g. Mark off 23 mm on the straight end of the safety fuze and insert into the detonator until the mark is just short of the lip of the cavity. On no account is a screw motion to be used.
- h. Carefully crimp the detonator to the safety fuze at a point about 5 to 10 mm from the open end of the detonator.
- i. Double the free end of the cord detonating 150 mm from the end and tape the detonator to it.

- j. Peg the safety fuze to the ground to prevent it from curling back after ignition and causing premature detonation.

14. **Detonation.** Proceed as follows:

- a. Ignite the scarfed end of the safety fuze by placing a match fuze on the exposed filling.
- b. Retire at least 200 m to cover with the used match and remain there until all the debris has fallen.
- c. In the event of a misfire, the demolition party is to wait thirty minutes before approaching the msl.
- d. If, when on approaching the msl smoke is seen, retire back to cover and wait a further thirty minutes commencing from the time that the last signs of smoke were seen.

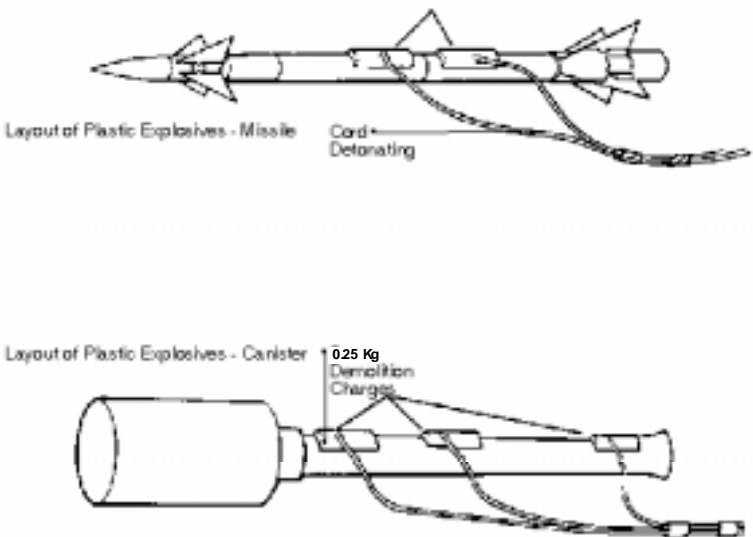


Figure 3-1: Layout of Plastic Explosives

CHAPTER 4

CARE AND MAINTENANCE

SERVICING

1. Servicing will be carried out:
 - a. daily when in use for msl canisters, LML and the AU; and
 - b. monthly when in storage.
2. Servicing consists of:
 - a. cleaning the optical assemblies;
 - b. cleaning the interface connections;
 - c. cleaning external surfaces of all equipment;
 - d. checking humidity indicators; and
 - e. FLTS testing of the AU.
3. Battery maintenance consists of cleaning the terminals.
4. No further servicing, other than that detailed in this chapter is to be carried out by the operator.
5. Careful cleaning of the optics will result in enhanced operational effectiveness, without risking scratched surfaces that would require repair action. It is essential, therefore, that the correct cleaning procedure is strictly adhered to.
6. Examine the interface connections on the AU and ready for use msl canisters for dampness or dirt. Clean as necessary using a clean, dry cloth and replace the protective covers.
7. Only approved cleaning materials as detailed in this section, are to be used.

8. The following precautions are to be taken to ensure the safe and satisfactory cleaning of optical assemblies:

- a. ensure that cleaning materials are not contaminated with grit, oil, etc.;
- b. before wet cleaning, ensure that all loose particles of grit or dirt are removed by carefully use of the soft hair brush; and
- c. do not touch polished optical surfaces with bare fingers.

9. The list of approved lens cleaning materials that are contained in the optical cleaning kit are listed below:

SERIAL	DESIGNATION
1	Paper, lens tissue, 10cm X 15cm
2	Methylated spirits (absolute) NSN 6810-21-877-1045 or equivalent
3	Brush, mop, no 6
4	Peg wood

CLEANING PROCEDURES

10. Remove grits and dust particles from the optical surface using the soft hairbrush.

11. Prepare a swab, using the peg wood wrapped with a lens tissue, and moisten but do not saturate, with Methylated spirits.

12. Using the swab in a light circular motion and starting from the centre of the optical surface remove all grease and smears. Finish off by sliding the swab around the edge to remove any accumulated dirt. Repeat as necessary, using a clean swab until the surface is clean.

13. Dry polish the surface in a similar manner using a dry lens tissue.

14. To prevent ingress of moisture, the AU battery terminals and sealing ring must be coated with MS4 grease.

WARNING

Under no circumstances should grease be allowed to come into contact the aiming unit optics.

15. Clean the outside of the AU, FLTS and ready for use msl canisters with a clean cloth.
16. Take care to ensure that the equipment is dry before replacing it in the FHC. If the tactical situation does not permit this, the equipment must be dried at the earliest opportunity.
17. Examination of equipment is to be carried out on ready for use msl canisters and the AU daily, when the tactical situation permits.

VERIFICATIONS

18. There is no requirement for testing the msl in the field. The checks constitute a visual examination to verify that the msl canister has not been damaged while in storage or transit. Any msl canister found to be damaged, or which is suspect in any way, must not be fired and is to be set aside for examination by the Ammunition Technician or disposal in accordance with SOP's.

19. On each msl canister **No. 1** checks to ensure that the:
- a. front cover is undamaged and correctly fitted to the msl canister;
 - b. msl canister forward tube is not fractured or delaminated;
 - c. hand locator is securely attached (see note below);

- d. forward tube is securely attached to the diaphragm in that the manacle clamp is secure and is in the correct position;
- e. diaphragm is not fractured;
- f. indicator is blue;
- g. interface connector is clean and undamaged;
- h. rear tube is not dented or cracked and there are no flaws in the metal;
- i. expansion cone is not damaged in such a way that it will obstruct the blow-out panel; and
- j. blow-out panel is undamaged and secure.

NOTE

If the hand locator is not secure, exceptional care must be taken during firing that the operator adopts the correct position with his left hand.

20. On the AU **No. 2** ensures that:
- a. the monocular and TX optics are clean and undamaged;
 - b. the indicator is blue, if not, FCS technician is to be informed;
 - c. the outer casing is not damaged;
 - d. the interface connector is serviceable, i.e., there is no pin misalignment or signs of damage; and
 - e. the AU/msl canister retaining clip is not damaged or worn; if it is, FCS technician is to be informed.

ROLE OF THE FIRST LINE TEST SET

21. Pass/fail testing of AU, LML and the FLTS.

22. The FLTS provides a testing facility for the Javelin AU and LML. The test set, which is used at the user level, is portable and is supplied with one disposable long life lithium battery. Three interconnecting cable assemblies are also supplied and used for attachment to the AU and for Built In Test (BIT) purposes.

23. The complete FLTS is contained in a lightweight field handling container; one spare lithium battery, two spare fuses, two spare collimator lamps, test adapter, Beta Light and a special screwdriver are also carried in this container. A shipping and storage container carries the FLTS within its field-handling container.

WARNING RADIATION

The equipment contain a beta lamp light source which by itself does not produce a significant level of external radioactivity and no hazard can arise unless a lamp is broken. In the event of breakage, evacuate and ventilate the immediate area for at least thirty minutes.

WARNING
HAZARDOUS MATERIAL

The equipment contains a disposable long life non-chargeable lithium battery. Do not open, puncture, crush or tamper with the battery as this could release or expose materials that are potentially flammable and hazardous to the skin and eyes. Do not attempt to charge the lithium battery.

24. The test set is essentially an aluminium alloy box comprising of a cover assembly and mounting plate assembly. The mounting plate houses the display and operator controls. The cover houses a lithium battery, connectors, desiccator assembly. A removable adapter plate assembly is also fitted to the front of the FLTS, which provides for mounting the FLTS onto the AU.

PURPOSE AND FUNCTION

25. To enable the testing of the AU the FLTS is mounted onto the AU and the AU supported on either a test stand or LML. The tests carried out consist of electrical tests on the AU circuitry, checking the guidance system signals and by interaction with the operator, all of the control mechanisms of the system.

26. During the AU test sequence the FLTS informs the operator via the display prompt where manual intervention is necessary.

27. The test set-up for the LML is almost identical to that of the AU with exception that there are three msl connections. In this case each is connected in turn and the msl selector switch on the sight arm assembly operates as part of the test. The FLTS performs a sub-set of the AU test sequence to verify the continuity of the cable from the traverse head.

FLTS CONTROLS AND FUNCTIONS

CONTROLS/ INDICATORS AND CONNECTORS	DESCRIPTION	PURPOSE
TX (Transmitter)	LED (red)	Lights when the TX supply is active
SF (System Fail)	LED (red)	Lights when the system has catastrophically failed
BL (Battery Low)	LED (red)	Lights when the battery voltage is low
SYS (System)	Switch	Provides power to the FLTS
TX (Transmitter)	Switch	This switch together with two safety interlock micro-switches form part of a transmit enable circuit. This circuit provides a TX supply for the unit under test when the micro-switches and the TX switch are set to ON
Display	Sixteen character starburst type, alphanumeric	Used to provide the operator with information both in the form of test results and to prompt for his interaction
Keyboard	Eight position keyboard	Used to select the mode of operation and to enable the operator to communicate with the system
SL (Shoulder Launch)	Mode button	Initiates the shoulder launch test
Lightweight Multiple Launcher	Mode button	Initiates the LML test

CONTROLS/ INDICATORS AND CONNECTORS	DESCRIPTION	PURPOSE
(LML)		
BIT (Built In Test)	Mode button	Initiates the Built In Test
DIM (Dimmer)	Button	When pressed will cause the display to go bright or dim
REC (Recall)	Button	When pressed will restart the display after a display timeout or recall the display message from its start
PASS	Button	This is pressed when a manual test has been successful
FAIL	Button	This is pressed when a manual test has been unsuccessful
CONT (Continue)	Button	This button is pressed to confirm completion of a manual interaction
SKC (Collimator)	19-pole socket	To connect the collimator to the FLTS using collimator harness
SKB (Test)	41-pole socket	To connect the FLTS to the AU under test using test harness
SKK (BIT)	41-pole socket	To connect the FLTS BIT output to the FLTS test harness using BIT harness
SKN (Diagnostics)	19-pole socket	For use by the manufacturer
SKE (SP)	12-pole socket	Not used

CONTROLS/ INDICATORS AND CONNECTORS	DESCRIPTION	PURPOSE
Micro-switch assembly	Two micro-switches and two actuators	This assembly together with the TX switch on the operator interface form part of safety interlock circuit
Fuse	1.25 amp	To protect the FLTS from damage in case of catastrophic failure
SPARE	1.25 amp	Spare fuse
Desicrator/ Humidity Indicator	Indicator	Used to detect moisture within the FLTS
EIapse Time Indicator	Indicator	Provides the maintenance authority of System On times

28. A timer is incorporated in the AU. If at any time during the test sequence the AU switches off due to the 25 second time limit, the operator will be prompted to set the AU system switch to OFF and then to ON and recommence at the start of the test sequence, which was interrupted.

29. If a non-critical fault occurs, i.e., a fault, which does not prohibit the use of the AU or LML, a warning prompt will be displayed at the end of the test sequence.

30. If a critical fault occurs, i.e., a fault, which makes the AU non-operational, the prompt:

“CRITICAL FAULT”
“nnn”
“PUSH CONTINUE”

(Where “nnn” is the fault code), will be displayed and the test sequence automatically aborted.

PHYSICAL DATA

31. **Dimensions.** The dimensions of the FLTS are as follows:

- a. **Operational**—16.5 in (419.1 mm) x 11.4 in (289.6 mm) x 11.6 in (294.7 mm).
- b. **Packaged**—20.0 in (508.0 mm) x 18.0 in (472.2 mm) x 14.1 in (358.15 mm).
- c. **Weight:**
 - (1) operation—10.4 kg; and
 - (2) packed—18.4 kg.

32. **Power Requirement.** One disposable long life lithium battery fitted to the FLTS and one fitted to the AU in use.

AIMING UNIT TESTING

33. AU tests are to be carried out daily. To ensure that no detail is overlooked, AU testing must be carried out using this drill book.

34. If any test fails, the sequence is to be repeated for verification and if it again fails an FCS technician is to be informed.

FIRST LINE TEST SET TESTING

35. The Built In Test (BIT) procedure for the FLTS is to be carried out before testing an AU.

PREPARATION FOR TESTS

36. Remove the FLTS from its FHC and:

- a. remove the three cable assemblies;
- b. ensure that the FLTS system switch is set to OFF;

- c. ensure that the TX switch is set to OFF;
- d. fit a lithium battery into the FLTS; and
- e. remove the protective caps from the cables and connect up the FLTS.

FLTS SWITCH ON PROCEDURE

37. Set the FLTS SYS switch to ON; wait, then SELECT MODE should appear on the FLTS display.

38. At “Switch On” the FLTS performs a Power On Self Test (POST) procedure. Under normal conditions, the first prompt will appear on the display. In the event of a fail condition, the message:

- a. ELEC/UNIT FAIL X (1 TO 8); or
- b. COLLIMATOR FAIL will be displayed.

39. Set brightness as required using the DIM button.

NOTE

If POST fails, details of the display are to be noted and FCS informed.

BUILT IN TEST PROCEDURES

40. If during BIT, “display timeout” occurs (flashing dot displayed), press the REC button to recall the display.

41. If any manually requested test fails, press FAIL instead of PASS. The message ELEC/UNIT FAIL 9 will be displayed.

42. If any automatic procedures fail, the message ELEC/UNIT FAIL 9 will be displayed.

43. If BIT fails, details of the display are to be noted and FCS informed.

FIRST LINE TEST SET BUILT IN TEST

SERIAL	TEST	PROMPT	FAULTS	REMARKS
1	Start Test	SELECT MODE		Press BIT button and display for next prompt.
2	Display independence test	PASS IF CHARS ARE THE SAME PUSH CONT TO START TEST		
3	Character set test	PASS IF SINGLE CHARACTER LIT PUSH CONT TO START TEST		
4	LED test	BATT LOW ON PUSH PASS/FAIL BATT LOW OFF PUSH PASS/FAIL COLL LAMP ON PUSH PASS/FAIL	BL LED lit when SYS switch is set to ON. BL LED not lit and display blank when SYS switch is set to ON. Collimator lamp does not light.	Replace batteries. Replace fuse and/or batteries (fuse rating, 1.25 amps). Replace collimator lamp. (lamp rating, 28.6 volts, 200 mA)

SERIAL	TEST	PROMPT	FAULTS	REMARKS
		COLL LAMP OFF? PUSH PASS/FAIL		
5	Keypad test	PUSH CONTINUE PUSH SL PUSH LML PUSH BIT PUSH DIMMER PUSH RECALL PUSH PASS PUSH FAIL PUSH CONTINUE		

SERIAL	TEST	PROMPT	FAULTS	REMARKS
6	Analogue and Digital tests	<p>SW TX ON, PUSH AND HOLD L/H MICROSWITCH THEN PUSH AND HOLD R/H MICROSWITCH, PUSH CONTINUE</p> <p>RELEASE L/H MICROSWITCH THEN PUSH AND HOLD R/H MICROSWITCH, PUSH CONTINUE</p> <p>NOW PUSH AND HOLD BOTH MICROSWITCHES, PUSH CONTINUE</p> <p>SW TX OFF AND HOLD BOTH MICROSWITCHES, PUSH CONTINUE</p> <p>RELEASE BOTH MICROSWITCHES, PUSH CONTINUE</p>		
7	Watchdog test	BIT PASSED AND TO EXIT TEST PUSH CONTINUE AND CHECK SF LED ON		

BUILT IN TEST CONCLUSION

44. Proceed as follows:
 - a. if necessary, set TX switch to OFF;
 - b. set SYS switch to OFF;
 - c. disconnect all cables from the FLTS;
 - d. remove the battery from the FLTS;
 - e. tighten the three collimator adjustment screws finger tight; and
 - f. stow the FLTS, battery and all cables in the FHC.

WARNING

1. Under no circumstances is the TX switch to be set to ON or Micros witches operated unless testing is being carried out.
2. It may be possible on some early issue FLTS to connect the collimator cable “pin to pin” at the collimator. Check cable orientation before fitting the collimator cable.

PREPARATION FOR TESTS (SL)

45. If necessary the AU is to be brought into action and mounted on the LML. Before mounting, ensure that the traverse head is locked in elevation and adjusted to a convenient height for testing.

46. At the AU:

- a. mount the AU onto the traverse head;
- b. remove the cover from the monitor plug P;
- c. remove the rubber window cover from the front of the guidance head;
- d. if necessary fit a lithium battery;
- e. ensure that the AU switches are set to the positions as follows:

SERIAL	SWITCH	POSITION
1	SYSTEM	OFF
2	FUSE MODE	2
3	CROSSWIND CORRECTION	CENTRE

- f. fit the Beta Light Assembly into the monocular window.

47. If necessary, remove the FLTS, test harness cable and collimator cable from the FHC.

- a. ensure that FLTS SYS and TX switches are set to OFF;
- b. if necessary fit the collimator cable (see WARNING 2, before para 45), and a lithium battery into the FLTS;
- c. ensure that the FLTS securing bolt is withdrawn;
- d. position the FLTS close to the LML stand and connect the test harness into the monitor plug P on the AU;
- e. mount the FLTS and collimator to the AU;
- f. tighten the securing bolt finger tight; and

- g. complete cabling.

NOTE

1. If during testing, the FLTS detects a non-critical fault which will not prevent an engagement from taking place, the prompt “AU WARNING” and fault condition together with a numerical readout will be displayed at the end of the test sequence. These numbers are to be noted and FCS informed.
2. If a critical fault occurs which renders the aiming unit unserviceable, CRITICAL FAULT and a numeric readout will be displayed and the testing sequence will be stopped. Details of the display are to be noted and FCS informed.
3. If during tests the aiming unit 25 second timer operates, the operator will be prompted to switch to OFF and then to ON.
4. Care must be taken not to move the FLTS and aiming unit during test 3, 6 and 12.
5. When firing trigger operation is required during the test sequence, the SYSTEM switch must be set to ON for at least 5 seconds before operating the trigger.

AIMING UNIT TEST PROCEDURE

48. Carry out Shoulder Launch tests as follows:

SER	TEST	PROMPT	FAULTS	REMARKS
1	Start test.	SELECT MODE		Press SL button.
2	Align collimator to AU cross wires.	ALIGN COLL TO AU X-WIRES PUSH CONTINUE		Adjust by using the three adjustment screws.
3	Run up at "System ON". AU batteries system switch DC-DC converter voltage regulator.	AU SW ON TX SW ON	CRITICAL 001 CRITICAL 002 CRITICAL 031 CRITICAL 032	AU powers supply faulty. TX power measured where none should be. FLTS TX switch faulty-voltage high. FLTS TX switch faulty-voltage low.

SER	TEST	PROMPT	FAULTS	REMARKS
		PUSH CONTINUE TX SW OFF HOLD AU STEADY, PUSH CONTINUE		
4	Range ring (R/R) and aiming ring (A/R) at “Switch On”.	R/R + A/R ON AND IN MARK 1 PUSH PASS/FAIL	CRITICAL 003 WARNING 1 R/R FAULT PUSH CONT	No Aiming Ring seen. NOTE: If the range ring or aiming ring is not lit and the FAIL button is pressed at this stage, the following prompt will appear: RANGE RING FAULT (PRE-TRIGGER).
5	Msl canister loop inhibits failure. Control logic firing sequence unit.	AU SW OFF		
		AU SW ON	CRITICAL 004	Msl canister loop inhibits failure.

SER	TEST	PROMPT	FAULTS	REMARKS
6	Rate-aided mode test. Pitch, yaw interrogators, rate sensor units, torque motions and aiming ring.	MOVE AU UP, DOWN, LEFT, RIGHT A/R LAGS X-WIRES PUSH PASS/FAIL	CRITICAL 028 CRITICAL 029	Release the azimuth and elevation locking bolts on the support head. Check aiming ring lags X-wires movement. Pitch offset faulty Yaw offset faulty.
		HOLD AU STEADY		
		A/R CENTRES?	CRITICAL 027	Insert the azimuth and elevation locking bolts on the support head. Check that the aiming ring returns to its original position. Central offset faulty
		PUSH PASS/FAIL		

SER	TEST	PROMPT	FAULTS	REMARKS
7	Wind offset switch operation. Tracking electronics, wind offset yaw torque motor and prediction units.	WIND SW CENTRE	CRITICAL 007	Wind input switch faulty.
		A/R IN MARK 1 ?	WARNING 2 A/R DRIFT FAULT PUSH CONT	Aiming ring is within collimator Mark 1 ring. Pre-IOF aiming ring drift rate is high.
		PUSH PASS/FAIL WIND SW RIGHT A/R GOES RIGHT?		Aiming ring moves to the right end of the AU X-wires.
		WIND SW LEFT A/R GOES LEFT?		Aiming ring moves to the left end of the AU X-wires.
		PUSH PASS/FAIL		

SER	TEST	PROMPT	FAULTS	REMARKS
		WIND SW CENTRE A/R CENTRES? PUSH PASS/FAIL		Aiming ring returns to the centre of the AU X-wires.
8	Joystick control pre-trigger operation.	MOVE J/S UP, DOWN, LEFT, RIGHT A/R CENTRES? PUSH PASS/FAIL	CRITICAL 008 CRITICAL 006	Pre-trigger joystick operation faulty. Pre-trigger AR does not lag X-wires nor return to centre.
9	5 Second timer inhibits pre-trigger.	WAIT AUTO TEST	CRITICAL 005	Pre-trigger occurs too early.
		NOTE: This prompt may not be displayed.	CRITICAL 021	FLTS unable to force timeout inhibits.

SER	TEST	PROMPT	FAULTS	REMARKS
			WARNING 2 PRETRIG TIMEOUT FAULT PUSH CONT	Pre-trigger timeout does not occur as specified.
10	Firing mechanism operation when SAFE.	WITH SAFETY ON PULL TRIGGER PUSH CONT	CRITICAL 012	Bad or non-existent trigger voltage.
11	Firing mechanism operation firing mode.	AU SW OFF AU SW ON WITH SAFETY OFF, PULL TRIGGER	CRITICAL 010	Wait 5 seconds. Bad or non-existent trigger pulses.
12	Aiming mark drift.	HOLD AU STEADY PUSH CONT		

SER	TEST	PROMPT	FAULTS	REMARKS
13	Joystick control, POST-trigger operation.	MOVE J/S UP, DOWN, LEFT, RIGHT. A/R STABLE? PUSH PASS/FAIL		Joystick has no effect on the position of the aiming ring.
14	25 Seconds timer inhibit, POST-trigger operation, and pre-IOF signal.	WAIT AUTO TEST	CRITICAL 011 CRITICAL 030	AU timed out post trigger and pre-IOF. FLTS unable to force timeout inhibits on AU.
15	Pod battery fire	WAIT AUTO TEST	CRITICAL 013	Bad or non-existent pod fire pulse.
16	First stage motor fire.	WAIT AUTO TEST		
17	Zoom time.	WAIT AUTO TEST	CRITICAL 016	Bad or non-existent zoom profile.

SERIAL	TEST	PROMPT	FAULTS	REMARKS
18	Fuse mode operation.	FUSE SW 1 PUSH CONTINUE	WARNING 6 FUSE SW 1 FAULT PUSH CONT	Fuse mode 1 operation incorrect.
		FUSE SW 2	WARNING 7 FUSE SW 2 FAULT PUSH CONT	Fuse mode 2 operation incorrect.
		PUSH CONT		
19	Joystick control, POST-IOF operation and joystick mirror limits.	MOVE J/S UP, DOWN, LEFT, RIGHT.		Aiming ring move in each direction by at least 50 mils and remains in the COLLI-MATOR FOV at all times.

SER	TEST	PROMPT	FAULTS	REMARKS
			<p>CRITICAL 014</p> <p>CRITICAL 018</p> <p>WARNING 4 PRE-IOF J/S FAULTY PUSH CONT</p>	<p>Early, bad or non existent IOF signal</p> <p>POST-IOF joystick operation faulty</p> <p>Pre-IOF joystick operation faulty.</p>
20	25 Seconds timer inhibit, POST trigger and POST-IOF operation.	<p>PUSH PASS/FAIL</p> <p>WAIT AUTO TEST</p>	<p>CRITICAL 015</p> <p>CRITICAL 030</p>	<p>POST IOF timeout too early.</p> <p>FLTS unable to force timeout inhibits on AU.</p>

SER	TEST	PROMPT	FAULTS	REMARKS
1	Start test.	SELECT MODE		Press SL button.
2	Align collimator to AU cross wires.	ALIGN COLL TO AU X-WIRES PUSH CONTINUE		Adjust by using the three adjustment screws.
3	Run up at "System ON". AU batteries system switch DC-DC converter voltage regulator.	AU SW ON TX SW ON	CRITICAL 001 CRITICAL 002 CRITICAL 031 CRITICAL 032	AU powers supply faulty. TX power measured where none should be. FLTS TX switch faulty-voltage high. FLTS TX switch faulty-voltage low.

SER	TEST	PROMPT	FAULTS	REMARKS
6	Rate-aided mode test. Pitch, yaw interrogators, rate sensor units, torque motions and aiming ring.	MOVE AU UP, DOWN, LEFT, RIGHT A/R LAGS X-WIRES PUSH PASS/FAIL	CRITICAL 028	Release the azimuth and elevation locking bolts on the support head. Check aiming ring lags X-wires movement.
			CRITICAL 029	Pitch offset faulty Yaw offset faulty.
		HOLD AU STEADY		Insert the azimuth and elevation locking bolts on the support head.
		A/R CENTRES?		Check that the aiming ring returns to its original position.
		PUSH PASS/FAIL	CRITICAL 027	Central offset faulty

SER	TEST	PROMPT	FAULTS	REMARKS
		WIND SW CENTRE A/R CENTRES? PUSH PASS/FAIL		Aiming ring returns to the centre of the AU X-wires.
8	Joystick control pre-trigger operation.	MOVE J/S UP, DOWN, LEFT, RIGHT A/R CENTRES? PUSH PASS/FAIL	CRITICAL 008 CRITICAL 006	Pre-trigger joystick operation faulty. Pre-trigger AR does not lag X-wires nor return to centre.
9	5 Second timer inhibits pre-trigger.	WAIT AUTO TEST	CRITICAL 005	Pre-trigger occurs too early.
		NOTE: This prompt may not be displayed.	CRITICAL 021	FLTS unable to force timeout inhibits.

SER	TEST	PROMPT	FAULTS	REMARKS
13	Joystick control, POST-trigger operation.	MOVE J/S UP, DOWN, LEFT, RIGHT. A/R STABLE? PUSH PASS/FAIL		Joystick has no effect on the position of the aiming ring.
14	25 Seconds timer inhibit, POST-trigger operation, and pre-IOF signal.	WAIT AUTO TEST	CRITICAL 011 CRITICAL 030	AU timed out post trigger and pre-IOF. FLTS unable to force timeout inhibits on AU.
15	Pod battery fire	WAIT AUTO TEST	CRITICAL 013	Bad or non-existent pod fire pulse.
16	First stage motor fire.	WAIT AUTO TEST		
17	Zoom time.	WAIT AUTO TEST	CRITICAL 016	Bad or non-existent zoom profile.

SER	TEST	PROMPT	FAULTS	REMARKS
			<p>CRITICAL 014</p> <p>CRITICAL 018</p> <p>WARNING 4 PRE-IOF J/S FAULTY PUSH CONT</p>	<p>Early, bad or non existent IOF signal</p> <p>POST-IOF joystick operation faulty</p> <p>Pre-IOF joystick operation faulty.</p>
20	25 Seconds timer inhibit, POST trigger and POST-IOF operation.	<p>PUSH PASS/FAIL</p> <p>WAIT AUTO TEST</p>	<p>CRITICAL 015</p> <p>CRITICAL 030</p>	<p>POST IOF timeout too early.</p> <p>FLTS unable to force timeout inhibits on AU.</p>

SER	TEST	PROMPT	FAULTS	REMARKS
			WARNING 5 POST IOF TIME OUT FAULT PUSH CONT	POST-IOF timeout does not occur as specified.
21	Superelevation system operation.	AU SW OFF AU SW ON APPLY S-ELEV	CRITICAL 020	Release the elevation locking bolt on the support head. Superelevation operation faulty Depress the SUPERELEVATION button and elevate the AU until the aiming ring is 45 mils down in the FOV of the monocular sight (45 mils down is denoted by the bottom end of the AU X-wires) Release the SUPERELEVATION button.

SER	TEST	PROMPT	FAULTS	REMARKS
		<p>WITH SAFETY OFF PULL TRIGGER</p> <p>A/R S-ELEV PUSH PASS/FAIL</p>		<p>Check that the aiming ring remains approximately 45 mils down. Wait 5 seconds.</p> <p>Disengage the safety catch and pull trigger.</p> <p>Check that the aiming ring jumps to the centre of the cross wires and then returns to its super-elevated position in approximately 2 seconds.</p>
22	Wind offset control, system operation and range ring off time.	<p>AU SW OFF</p> <p>AU SW ON</p>	CRITICAL 019	<p>Insert the elevation bolt on the support head.</p> <p>POST-IOF wind offset operation faulty.</p>

SER	TEST	PROMPT	FAULTS	REMARKS
		WIND SW RIGHT PUSH CONT WATCH A/R WITH SAFETY OFF PULL TRIGGER A/R CENTRES? PUSH PASS/FAIL A/R GOES RIGHT AND R/R OFF? PUSH PASS/FAIL WIND SW CENTRE		Aiming ring moves to the right and wait 5 seconds. Aiming ring returns to its original position. After 2 seconds the range ring disappears.

SER	TEST	PROMPT	FAULTS	REMARKS
		PUSH CONTINUE		
23	Align collimator to the clamped aiming ring.	ALIGN COLL TO A/R PUSH CONTINUE TX SW ON		Using the collimator adjusting screws.
24	Alignment, wide angle.	AUTO TEST WAIT FOR NEXT PROMPT	CRITICAL 022	Wide angle alignment faulty.
25	Pattern size, wide angle.	AUTO TEST WAIT	CRITICAL 023	Wide angle pattern size faulty.
26	Alignment, narrow angle.	AUTO TEST WAIT	CRITICAL 024	Narrow angle alignment faulty.

SER	TEST	PROMPT	FAULTS	REMARKS
27	Pattern size, narrow angle.	AUTO TEST WAIT	CRITICAL 025	Narrow angle pattern size faulty.
28	Pattern power output.	AUTO TES WAIT	CRITICAL 026	Pattern power faulty.
29	Feed forward test.	MOVE J/S FULLY DOWN AND HOLD RELEASE J/S PUSH CONTINUE MOVE J/S FULLY RIGHT AND HOLD RELEASE J/S PUSH CONTINUE		
30	AU battery voltage, check at end of sequence	TX SW OFF AU SW OFF		
31	Tests complete	SL PASSED		PUSH CONTINUE

SHOULDER LAUNCH TESTS CONCLUSION

49. **Procedure:** Proceed as follows:

- a. Set the FLTS SYS switch to OFF.
- b. Disconnect the test harness from the FLTS and SKA on the AU.
- c. Release the securing bolt and remove the FLTS.
- d. Disconnect the test harness from the monitor plug P on the AU.
- e. Disconnect the collimator cable from the FLTS.
- f. Remove the lithium battery from the FLTS.
- g. Tighten the three-collimator adjustment screws finger tight.
- h. Stow all cable, the battery and the FLTS in the FLTS FHC.
- i. Replace the monitor plug cover on the AU.

LIGHTWEIGHT MULTIPLE LAUNCHER TESTS

50. Carry out LML tests as follows:

SERIAL	TEST	PROMPT	FAULT	REMARKS
1	Prompt mode.	SELECT MODE		On FLTS, press LML button.
2	LML test. Correct position required.	CHECK MSL SEL SW TO REQ'D POSN		On LML select position 1.
3	Msl canister loop test.	PUSH CONT	CRITICAL 004	Msl canister loop inhibits failure.
		TX SW OFF AU SW ON PUSH CONTINUE AU SW OFF	CRITICAL 031 CRITICAL 001	FLTS TX switch faulty – voltage high. AU power supply faulty.

SERIAL	TEST	PROMPT	FAULTS	REMARKS
4	Trigger line test.	AU SW ON WITH SAFETY OFF PULL TRIGGER	CRITICAL 009	Wait 5 seconds. Trigger volts measured where none should be.
5	Fuse line test.	FUSE SW 1 PUSH CONTINUE FUSE SW 2	WARNING 6 FUSE SW 1 FAULT PUSH CONTINUE WARNING 7 FUSE SW 2 FAULT PUSH CONTINUE	Fuse mode 1 operation incorrect. Fuse mode 2 operation incorrect.
6	TX safety loop test.	ALIGN COLL TO A/R		Using the collimator adjustment screw, accurately align collimator X-wires to the aiming ring.

SERIAL	TEST	PROMPT	FAULTS	REMARKS
		PUSH CONTINUE TX SW ON WAIT TX SW OFF AU SW OFF LML PASSED PUSH CONTINUE WAIT SELECT MODE		Auto test.

NOTE

1. These tests are to be repeated at each position of the **LML MISSILE SELECT** switch.
2. When changing the position of the **LML SELECT** switch ensure that the test harness cable is connected to the appropriate chute.

**LIGHTWEIGHT MULTIPLE LAUNCHER TESTS
CONCLUSION**

51. **Procedure.** Proceed as follows:

- a. Set the FLTS SYS switch to OFF.
- b. Disconnect the test harness from the FLTS.
- c. Release the securing bolt and remove the FLTS.
- d. Disconnect the test harness from the LML and AU.
- e. Disconnect the collimator cable from the FLTS.
- f. Remove the lithium battery from the FLTS.
- g. Tighten the three collimator adjustment screws finger tight.
- h. Stow all cables, battery and FLTS in the FLTS FHC.
- i. Fit the monitor plug P cover on the AU.

AIMING UNIT STABILIZATION TEST

52. Carry out the stabilization test as follows:

SERIAL	ITEM	TEST/ ACTION
1	Stabilization test adapter.	Remove the stabilization test adapter from the FLTS FHC and insert it into SKA on the AU.
2	Traverse head	Unclamp the elevation locking lever.
3	Sight cross wires.	View a distant object through the monocular sight and position the sight cross wires on the object.
4	SYSTEM switch.	Set to ON.
5	Aiming ring.	Align the aiming ring with the object.
6	Firing mechanism.	Disengage the safety catch and operate the trigger.
7	AU.	Move the AU so that the cross wires move to the Left, Right, Up and Down positions in turn, then back to the object. Check that the aiming ring remains in approximate alignment, allowing for drift (see Note 1)
8	SYSTEM switch.	Set to OFF then back to ON, wait four seconds then set back to OFF (see Note 2).
9	LML locking lever	Clamp the LML locking lever.

NOTE

1. The amount of drift should not exceed 45 mils in 10 seconds (45 mils is the distance from the centre to the ends of the cross wires).
2. Setting the SYSTEM switch to ON for 4 seconds, allow the TX zoom lens to reset.

AIMING UNIT STABILIZATION TEST CONCLUSION

53. **Procedure.** Proceed as follows:

- a. Remove the Beta Light assembly from the AU and stabilization test adapter from SKB LML chute 1, and stow them in the FLTS FHC.
- b. If necessary replace the AU battery.
- c. Carry out the load or cease firing drills (see Chapter 2).

ANTI-ICING PROCEDURE

54. The equipment should be protected as much as possible from exposure to freezing rain or mist. Anti-icing procedures must be carried out when the ambient temperature falls below 0° C and:

- a. exposure is unavoidable, all AUs and msl canisters immediately prior to mating the weapon systems;
- b. before repackaging after use, on all AUs, msl canisters and FHC; and

- c. immediately after fording, all AUs FLTS and msl canisters with their FHC, which have been totally or partially immersed in water.

55. Anti-icing fluid can cause the eyes to sting for a short period. Avoid rubbing the eyes if hands are contaminated with the fluid or bringing eyes into contact with surfaces treated with the fluid, e.g., monocular eyepiece.

56. Tools and materials required are listed below:

SERIAL	DESIGNATION
1	Methanol Technician 25 oz bottle NSN 6810-21-877-1045 or equivalent
2	Brush, varnish, flat, 12 mm

APPLICATION OF ANTI-ICING FLUID

57. Using the brush apply a thin film of the fluid to the following parts:

- a. The AU:
 - (1) all switches;
 - (2) operationally moving parts;
 - (3) surfaces normally in contact with the FHC;
 - (4) surfaces which normally mate with the msl canister, ensuring the fluid is brushed well in behind the AU retaining clip;
 - (5) interface connector retaining ring and “floating” section (great care should be taken to ensure the fluid is not allowed to contaminate contacts of the interface connector);

- (6) monocular eyepiece rubber; and
 - (7) surfaces of batteries that come into contact with the battery box, taking care that fluid does not contaminate battery contacts and screws.
- b. The msl canister:
- (1) pressure equalizing valve;
 - (2) msl canister forward tube and joint between front end cover and tube;
 - (3) surfaces normally in contact with the FHC;
 - (4) surfaces which normally mate with the AU, paying particular attention to the AU attachment saddle cut out; and
 - (5) blow out panel.
- c. The FLTS:
- (1) keyboard/display and switches;
 - (2) surfaces normally in contact with the FHC; and
 - (3) surfaces which normally mate with the AU.
- d. Drain any residual water from the AU, msl canister and FHC. Using a brush apply a thin film of the fluid to the following parts:
- (1) parts of the container normally in contact with the AU;
 - (2) mating surfaces of both halves of the container; and
 - (3) securing straps and fasteners.

NOTE

When the FHC are closed, do not stow the free ends of the securing loops. This will assist in opening the container if ice forms on the straps.

58. For the optics proceed as follows:
- a. Prepare a swab, using the peg wood wrapped with paper lens tissue and moistened (NOT SATURATED) with Methylated spirit.
 - b. Using a light circular motion from the centre of the optical surface outward, moisten the iced surface with Methylated spirit. Repeat as necessary using a clean swab each time until the ice is completely removed and the surface is perfectly clean.
 - c. Lightly polish the surface in a similar manner using a clean dry paper tissue.
 - d. Prevent further icing by avoiding breathing onto optical surfaces.

WARNING

Damage could result and performance be degraded if anti-icing fluid is allowed to contaminate the optical surfaces. Before operating AUs which have been treated with anti-icing fluid, all optics must be wiped clean in accordance with this chapter, to remove any fluid or ice which may have formed. The rubber eye shield on the monocular must be wiped with a clean cloth, to prevent any trace of the fluid affecting the eyes.